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The Paradox of Equator-Pole Temperature Contrast in Past Climates

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Paleotemperatures from several past eras imply that tropical sea surface temperatures have remained nearly constant despite significant changes in global mean temperature. Theoretical models fail to agree with this observation, though their global mean response to greenhouse gases is consistent with the paleodata. The models' ability to change meridional heat transport (oceanic or atmospheric) may be less than that of the real Earth. Then tropical SSTs could be stabilized because forcing such as enhanced greenhouse warming is compensated by increased transport of heat from the tropics to higher latitudes. With standard assumptions of climate feedback, the required heat transport changes are quite large.

Changes in meridional heat transport could also cause changes in global mean temperature through nonlinear feedback in planetary albedo or longwave radiation. The mechanism could work if climate models are even more erroneous than suggested above (Lindzen, *Ann. Rev. Fluid Mech.* 1994). In this view models represent feedback poorly and overestimate climate sensitivity to greenhouse gases. We believe the less radical critique of climate models is the most likely explanation of the Equator-Pole temperature contrast paradox. Systematic testing of the different possible explanations, however, is a prerequisite for trusting model predictions of future climates.

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